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CANTOR COLBURN, LLP
55 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002

EXAMINER	
THOMPSON, JAMES A	

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/786,499
Filing Date: March 02, 2001
Appellant(s): HOBSON ET AL.

Jennifer Pearson Medlin
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 24 August 2007 appealing from the Office action mailed 21 September 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,394,151	KNAELL ET AL	2-1995
5,535,291	SPENCER ET AL.	7-1996
5,799,100	CLARKE ET AL.	8-1998
4,099,179	HOFSTEIN	7-1978
5,226,019	BAHORICH	7-1993

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-3 and 5-16 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-3 and 5-16 recite performing mathematical functions on a set of data values encoded in a signal. Mathematical manipulations upon data are not patentable. The data may be transmitted data, but it is still data. Further, the Office does not recognize a signal *per se* to be statutory since a signal is neither a process, machine, article of manufacture, or composition of matter. The signal itself is simply energy. The data encoded in the signal is simply data. Claims 1-3 and 5-16 are merely mathematical operations that are to be performed on the encoded data. The algorithmic manipulation of data simply for the purpose of generating altered data is not statutory. Furthermore, claims which merely recite applying such a mathematical algorithm to a set of data are an attempt to patent an abstract idea, and thus pre-empt every substantial practical application of the abstract idea, because such a patent in practical effect would be a patent on the idea itself (Benson, 409 U.S. at 71-72, 175 USPQ at 676; cf, Diehr, 450 U.S. at 192,209 USPQ at 10). Finally, since the recited claims are simply mathematical operations upon data to generate a different set of data (reconstructed signal), the claims as presently recited do not provide a *concrete, tangible and useful* result.

Claims 1-2, 5-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knaell (US Patent 5,394,151) and Spencer (US Patent 5,535,291).

Regarding claim 1: Knaell discloses a method of reconstructing an image from a signal, the image derived from measurements of a physical object characterized by a first prediction function (three-dimensional function of object) representing a predictable effect of an apparatus (column 4, lines 64-66

and column 5, lines 7-10 of Knaell), and a noise function representing unpredictable noise (column 6, lines 60-63 and column 9, lines 23-26 of Knaell), the method comprising the steps of:

- altering an original coordinate basis (three-dimensional) of the object to produce at least one other coordinate basis (column 4, line 64 to column 5, line 10 of Knaell), the at least one other coordinate basis having a plurality of spaces (figure 3A(1,2,3) and column 7, line 64 to column 8, line 2 of Knaell – two-dimensional data acquisition at each point) with a lower dimensionality than a space within the original coordinate basis (column 5, lines 7-10 of Knaell), the set of data in the at least one other coordinate basis represented by a second prediction function (two-dimensional function) of the signal in the at least one other coordinate basis (column 5, lines 7-18 of Knaell). The original coordinate bases is a three-dimensional coordinate basis since the object measured is a three-dimensional object. Thus, the original data, which is the data corresponding to the object itself, is altered from a three-dimensional coordinate basis to a two-dimensional coordinate basis.
- performing a Bayesian reconstruction (column 6, lines 38-47 of Knaell) utilizing the second prediction function to produce a reconstruction signal (column 6, lines 57-66 of Knaell), the Bayesian reconstruction capable of operation of positive, negative and complex signal values (column 6, lines 47-56 of Knaell). Since positive and negative signal values are simply complex values without an imaginary component, the Bayesian reconstruction is capable of operation of positive, negative and complex signal values (column 6, lines 47-56 of Knaell).
- converting the reconstruction signal back into the original coordinate basis to generate a signal (figure 5B("Display 3-D Image") and column 9, lines 6-14 of Knaell).

Knaell does not disclose expressly that said reconstruction is of a previously produced signal from a given set of data, the set of data characterized by a first prediction function representing a predictable effect of an apparatus on the previously produced signal, and a noise function representing

unpredictable noise contributed to the previously produced signal; that the Bayesian reconstruction utilizes a maximum entropy method; and that said converting generates the previously produced signal.

Spencer discloses:

- reconstructing a previously produced signal from a given set of data (column 5, lines 8-13 and lines 18-25 of Spencer), the set of data characterized by a first prediction function representing a predictable effect of an apparatus on the previously produced signal (column 5, lines 27-36 of Spencer), and a noise function representing unpredictable noise contributed to the previously produced signal (column 6, lines 43-46 of Spencer).
- performing Bayesian reconstruction utilizing a maximum entropy method (column 5, lines 8-10 of Spencer).
- converting the reconstruction signal to generate the previously produced signal (column 4, line 65 to column 5, line 7 of Spencer).

Knaell and Spencer are combinable because they are from the same field of endeavor, namely the conversion and reconstruction of images and signals using Bayesian reconstruction. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a previously produced signal for reconstruction, as taught by Spencer, rather than relying upon direct measurements, as taught by Knaell. Thus, the combined system of Knaell and Spencer would take two-dimensional slices of three-dimensional noisy data, rather than imaging directly from a three-dimensional object. The motivation for doing so would have been to be able to apply the reconstruction technique to already obtained three-dimensional data, rather than applying the reconstruction technique solely to existing physical objects that have to be measured. By applying the system of Knaell in the context of the teachings of Spencer, the overall capabilities of the system of Knaell are increased, which is a clear benefit. Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use the maximum entropy method for Bayesian reconstruction, as taught by Spencer. The motivation for

doing so would have been that the maximum entropy method provides a significant improvement in resolution, and thus in the ability to detect/distinguish closely spaced objects (column 5, lines 17-21 of Spencer). Therefore, it would have been obvious to combine Spencer with Knaell to obtain the invention as specified in claim 1.

Regarding claim 2: Knaell discloses that the Bayesian reconstruction is performed using a Fourier basis (column 5, equation 4 and lines 63-65 of Knaell).

Regarding claim 5: Knaell discloses employing an evaluation parameter, α, which is determined from a prior reconstruction (column 5, line 66 to column 6, line 2 and column 6, equation 3 of Knaell). Whether the evaluation parameter is referred to as α or a_i is merely a matter of nomenclature.

Regarding claim 6: Knaell discloses employing an evaluation parameter, α, which is set at a fixed value (column 5, line 66 to column 6, line 2 and column 6, equation 3 of Knaell). Whether the evaluation parameter is referred to as α or a_i is merely a matter of nomenclature.

Regarding claim 7: Knaell discloses employing an evaluation parameter, α, which is determined during the reconstruction step (column 5, line 66 to column 6, line 2 and column 6, equation 3 of Knaell). Whether the evaluation parameter is referred to as α or a_i is merely a matter of nomenclature.

Regarding claim 8: Knaell discloses that the signal to be reconstructed is an image signal (column 5, lines 53-60 of Knaell). By combination with Spencer, the signal is the previously produced signal, as set forth in the arguments regarding claim 1.

Regarding claim 10: Knaell discloses that the signal to be reconstructed is a radar signal (column 4, lines 64-66 of Knaell). By combination with Spencer, the signal is the previously produced signal, as set forth in the arguments regarding claim 1.

Claims 3 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knaell (US Patent 5,394,151), Spencer (US Patent 5,535,291), and Clarke (US Patent 5,799,100).

Regarding claim 3: Knaell and Spencer does not disclose expressly that the Bayesian reconstruction is performed using a wavelet basis.

Clarke discloses reconstruction of images using a wavelet basis (column 10, lines 60-67 of Clarke).

Knaell and Spencer are combinable with Clarke because they are from the same field of endeavor, namely the reconstruction of images. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a wavelet basis, as taught by Clarke, rather than a Fourier basis, as taught by Knaell. The suggestion for doing so would have been that a directional wavelet transform has a corresponding Fourier transform (column 9, lines 17-30 of Clarke), and thus a wavelet transform is an alternate transform method for image signal data. Therefore, it would have been obvious to combine Clarke with Knaell and Spencer to obtain the invention as specified in claim 3.

Regarding claim 9: Knaell and Spencer does not disclose expressly that said image signal is a medical image signal.

Clarke discloses reconstructing an medical image signal (column 11, lines 36-42 of Clarke).

Knaell and Spencer is combinable with Clarke because they are from the same field of endeavor, namely the reconstruction of images. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically reconstruct a medical image, as taught by Clarke. The suggestion for doing so would have been that the system of Knaell is applicable to 3-dimensional image reconstruction in general. A medical image signal is simply another type of image that can be reconstructed. Therefore, it would have been obvious to combine Clarke with Knaell and Spencer to obtain the invention as specified in claim 9.

Claims 11-12 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knaell (US Patent 5,394,151), Spencer (US Patent 5,535,291), and Hofstein (US Patent 4,099,179).

Regarding claims 11-12: Knaell and Spencer does not disclose expressly that the previously produced signal to be reconstructed is an acoustic data signal, wherein the acoustic data signal is an underwater sonar signal.

Hofstein discloses reconstructing an acoustic data signal (column 7, lines 22-30 of Hofstein), wherein said acoustic data signal is an underwater sonar signal (column 7, lines 9-15 of Hofstein).

Knaell and Spencer is combinable with Hofstein because they are from the same field of endeavor, namely digital image data processing and display. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use sonar signals as the input signal for image reconstruction, as taught by Hofstein. The motivation for doing so would have been to obtain information regarding objects and events below the surface of the water (column 7, lines 9-12 of Hofstein). Therefore, it would have been obvious to combine Hofstein with Knaell and Spencer to obtain the invention as specified in claims 11-12.

Regarding claim 15: Knaell does not disclose expressly that the previously produced signal is a communication signal.

Hofstein discloses processing a radio signal (column 6, lines 65-68 of Hofstein), which is a form of communication signal.

Knaell and Spencer are combinable with Hofstein because they are from the same field of endeavor, namely digital image data processing and display. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a communication signal as the signal to process, as taught by Hofstein. The motivation for doing so would have been to scan target objects based on the return echoes of said communication signals (column 6, lines 63-65 of Hofstein). Therefore, it

would have been obvious to combine Hofstein with Knaell and Spencer to obtain the invention as specified in claim 15.

Claims 13 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knaell (US Patent 5,394,151), Spencer (US Patent 5,535,291), Hofstein (US Patent 4,099,179), and Bahorich (US Patent 5,226,019).

Regarding claim 13: Knaell, Spencer and Hofstein does not disclose expressly that the acoustic data signal is a geophysical data signal.

Bahorich discloses processing geophysical data signals (column 3, lines 60-61 and column 4, lines 6-10 of Bahorich).

Knaell, Spencer and Hofstein is combinable with Bahorich because they are from the same field of endeavor, namely digital image data processing and display. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically acquire and process geophysical data, as taught by Bahorich. The motivation for doing so would have been to obtain information about the Earth's structure, lithology, geology, and pore fluid content (column 2, lines 53-57 of Bahorich). Therefore, it would have been obvious to combine Bahorich with Knaell, Spencer and Hofstein to obtain the invention as specified in claim 13.

Regarding claim 16: Knaell, Spencer and Hofstein does not disclose expressly that the communication signal is a time-series signal.

Bahorich discloses processing a time-series signal (column 2, lines 53-57 of Bahorich).

Knaell, Spencer and Hofstein is combinable with Bahorich because they are from the same field of endeavor, namely image data processing and display. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use a time-series signal, as taught by Bahorich. The motivation for doing so would have been that time-series signals are useful for extracting

a variety of information (column 2, lines 53-57 of Bahorich). Therefore, it would have been obvious to combine Bahorich with Knaell, Spencer and Hofstein to obtain the invention as specified in claim 16.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Knaell (US Patent 5,394,151), Spencer (US Patent 5,535,291), and Larson (US Patent 5,252,922).

Regarding claim 14: Knaell and Spencer does not disclose expressly that the previously produced signal to be reconstructed is a signal from spectroscopy.

Larson discloses reconstructing images from spectroscopy (column 4, lines 25-31 of Larson).

Knaell and Spencer is combinable with Larson because they are from the same field of endeavor, namely digital image data processing and display. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use spectroscopic imaging, as taught by Larson. The motivation for doing so would have been that spectroscopy can provide spatially resolved discrimination of medical tissue images (column 4, lines 30-35 of Larson). Therefore, it would have been obvious to combine Larson with Knaell and Spencer to obtain the invention as specified in claim 14.

(10) Response to Argument

Regarding page 4, line 9 to page 5, line 9 of Appellant's Arguments:

Briefly, claim 1 takes a set of data, alters the data to another coordinate basis of lower dimensionality, performs Bayesian reconstruction to produce a reconstruction signal, and converts the reconstructed signal back into the original coordinate basis to generate the previously produced signal. Thus, claim 1 merely performs mathematical operations upon signal data. Claim 1 fails the requirements of 35 U.S.C. § 101 for at least three separate and distinct reasons.

Firstly, claim 1 is merely a mathematical algorithm that is performed internally in a system, such as a computing system, upon data to produce other data. Thus, claim 1 as a whole does not accomplish a practical application, nor does claim 1 produce a useful, concrete and tangible result. See MPEP § 2106(II)(a). Internal manipulation of data using an algorithm does not have any real world application. While Appellant may have intended to include additional elements or steps that would have taken the internally manipulated data and generated a useful output, such elements or steps are not presently recited in claim 1.

Secondly, claim 1 recites a signal, along with the mathematical functions that are performed on the signal. It has been held that "if the 'acts' (in this case, the steps of the method) of a claimed process manipulate only numbers, abstract concepts, or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter" and that "a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process." See MPEP § 2106.02. See also *Gottschalk v. Benson*, 409 U.S. 63,71-72, 175 USPQ 673,676 (1972). Not only does claim 1 merely perform mathematical operations which convert one set of numbers into another set of numbers, claim 1 performs these mathematical operations on signals. Signals themselves are not statutory since a signal is merely energy and is neither a process, machine, article of manufacture, or composition of matter. So, claim 1 merely converts one set of data, in the form of energy, into another set of data, also in the form of energy.

Thirdly, claim 1 recites an abstract idea, and thus attempts to patent the idea itself. Claims which merely recite applying a mathematical algorithm to a set of data are an attempt to patent an abstract idea, and thus pre-empt every substantial practical application of the abstract idea, because such a patent in practical effect would be a patent on the idea itself. See *Benson*, 409 U.S. at 71-72, 175 USPQ at 676; *cf*, *Diamond v. Diehr*, 450 U.S. 175,192, 209 USPQ 1,10 (1981).

For the three reasons articulated above, claim 1 does not comply with the requirements of 35 U.S.C. § 101. Claims 2-3 and 5-16 depend, either directly or ultimately, from claim 1 and do not add limitations which would render any one of claims 2-3 and 5-16 compliant with 35 U.S.C. § 101. Claims 2-3 and 5-16 merely add further limitations to the mathematical algorithm recited in claim 1.

Regarding page 5, line 11 to page 7, line 24 of Appellant's Arguments:

The specific language of claim 1 recites "altering an original coordinate basis of the object to produce at least one other coordinate basis". As stated in the final rejection of 21 September 2006 and shown in Knaell (USPN 5,394,131), the original coordinate basis is a three-dimensional coordinate basis since the object that is measured by the synthetic aperture radar (SAR) system is a three-dimensional object (see page 5, lines 7-12 of final rejection). The three-dimensional coordinate basis of the object is altered to a two-dimensional coordinate basis *via* the SAR image capturing, which performs a plurality of two-dimensional image capture operations at specific sample points (see column 4, line 64 to column 5, line 10 of Knaell). The captured two-dimensional images are used to reconstruct a three-dimensional image of the three-dimensional object (see figure 5B and column 9, lines 6-14 of Knaell). While the image that ultimately results is a three-dimensional image, two-dimensional images are first obtained from the three-dimensional object. In fact, a resulting three-dimensional image would be required by the recited claim language since claim 1 recites "converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal." Thus, the conversion of the two-dimensional reconstruction signal captured by the SAR back into the original three-dimensional coordinate basis reads on "converting the reconstruction signal back into the original coordinate basis to generate a signal". The generated signal is the previously produced signal according to the combination of Knaell and Spencer (USPN 5,535,291), as set forth in the final rejection (see page 6, line 4 to page 7, line 13 of final rejection).

Further, the combination of Knaell and Spencer is proper. Knaell and Spencer are analogous art since both are from the same field of endeavor, namely the conversion and reconstruction of images and signals using Bayesian reconstruction. Additionally, Spencer is not relied upon for every complex detail contained therein. Spencer is relied upon for its teaching with respect to using a previously produced signal for reconstruction, rather than relying upon direct measurements, as taught by Knaell, and for its teaching to specifically use the maximum entropy method for Bayesian reconstruction. Using already obtained data, rather than performing a new capture of image data, and using a specific type of Bayesian reconstruction when the primary reference already teaches using Bayesian reconstruction is well within the level of ordinary skill in the art. The combined system of Knaell and Spencer would therefore take two-dimensional slices of three-dimensional noisy data, rather than imaging directly from a three-dimensional object. The motivation for using a previously produced signal for reconstruction would have been to be able to apply the reconstruction technique taught by Knaell to already obtained three-dimensional data, rather than applying the reconstruction technique solely to existing physical objects that have to be measured. By applying the system of Knaell in the context of the teachings of Spencer, the overall capabilities of the system of Knaell are increased, since the combined system can now additionally process three-dimensional image data using Bayesian reconstruction without the need for performing new image capturing. Further, the motivation for specifically using the maximum entropy method for Bayesian reconstruction, as taught by Spencer, would have been that the maximum entropy method provides a significant improvement in resolution, and thus in the ability to detect/distinguish closely spaced objects (column 5, lines 17-21 of Spencer). Since the references are analogous art, all of the limitations of the claim are met, the proposed modifications are within the level of ordinary skill in the art, and there is a clear motivation to combine the references, the combination is proper.

Finally, since claim 1 is demonstrated to be properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Knaell in view of Spencer, claims 2, 5-8 and 10 cannot be deemed allowable for the same reasons as presented by Appellant for claim 1.

Regarding page 7, line 26 to page 8, line 9 of Appellant's Arguments:

Since claim 1 is demonstrated to be properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Knaell in view of Spencer, claims 3 and 9 cannot be deemed allowable for the same reasons as presented by Appellant for claim 1.

Regarding page 8, lines 11-25 of Appellant's Arguments:

Since claim 1 is demonstrated to be properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Knaell in view of Spencer, claims 11, 12 and 15 cannot be deemed allowable for the same reasons as presented by Appellant for claim 1.

Regarding page 8, line 27 to page 9, line 10 of Appellant's Arguments:

Since claim 1 is demonstrated to be properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Knaell in view of Spencer, claims 13 and 16 cannot be deemed allowable for the same reasons as presented by Appellant for claim 1.

Regarding page 9, lines 12-26 of Appellant's Arguments:

Since claim 1 is demonstrated to be properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Knaell in view of Spencer, claim 14 cannot be deemed allowable for the same reasons as presented by Appellant for claim 1.

Conclusion:

Examiner has demonstrated both in the claim rejections and in the Response to Appellant's Arguments set forth above that the appealed claims have been properly rejected under 35 U.S.C. § 101 and under 35 U.S.C. § 103(a). Therefore, Examiner respectfully requests the Board to affirm the final rejection of 21 September 2006.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

James A. Thompson

Conferees:

David K. Moore

**DAVID MOORE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600**

King Y. Poon

KING Y. POON
SUPERVISORY PATENT EXAMINER